

NextGen Surface Trajectory-Based Operations (STBO)

Project Overview

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Air Traffic Organization – NextGen & Operations Planning
Advanced Technology & Prototyping Group

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Federal Aviation
Administration



Advanced Technology & Prototyping Group

Mission: Accelerate deployment of new technologies by bridging the gap between research and development (R&D) and implementation

- Receive research and development (R&D) products from NASA or another advanced R&D facility
- Mature promising aviation technologies that fill FAA mission needs
 - Additional development work (simulations / field demonstrations)
 - Initiate FAA Acquisition Management System (AMS) documents
 - Assist implementing organizations in obtaining successful investment decisions
- Products to date
 - ASDE-X
 - Data Distribution
 - ADS-B
 - RWSL



STBO Program Description

- **Trajectory Management – Surface Tactical Flow: G2A 01- 01 (FY08-FY10)**
 - Support Initial Investment Decision on near-term Surface Traffic Management capabilities
 - Field evaluations of near- and mid term capabilities at MEM and MCO
 - Develop road map leading to Surface Trajectory-Based Operations (STBO)
- **Trajectory Management – Surface Conformance Monitoring: G2A 01- 02 (FY09-FY10)**
 - Develop concept, requirements, and procedures for surface (taxi) conformance monitoring
- **Partners / Stakeholders**
 - ATO Terminal, SysOps
 - Memphis ATCT/TRACON, ARTCC TMU
 - Airlines
 - FedEx
 - NWA/Delta (beginning in mid-FY10)
 - Orlando ATCT, TRACON

STBO Products

- **Risk Mitigation**
 - Test promising capabilities
 - Fast time simulations, HITL simulations, field evaluations
 - Validate performance and benefits
 - Mature capabilities that continue to display merit
 - Eliminate capabilities that fail to perform
- **Technical Transfer of Mature Decision Support Tool Proven Through Field Evaluation**
 - ConUse
 - Preliminary Program Requirements (pPR)
 - Operational Procedures
 - Safety Risk Management Analysis
 - Business case
 - Algorithm description



STBO Field Test Beds

- **Installed and Maintained by STBO Project Team**
 - Two locations
 - Memphis
 - Orlando
 - Installed on 2-year Test NCP's
 - System C&A (SCAP) recently approved
- **Provide Rapid Prototyping Capabilities**
 - Redundant COTS hardware
 - Government-owned, modular software
 - Suitable for long-term operation with minimal upkeep
 - Building interfaces for airline collaboration
 - Enables “drop in” testing of new surface capabilities

STBO Development Lab

- **Provides live replicas of STBO prototype installations**
 - Memphis
 - Orlando
- **Enables 24/7 surface metrics data collection for post operational analysis / business case development**
 - Memphis
 - Orlando
 - JFK
- **Support for field test beds**
 - Testing of new software builds
 - Bug fixes
 - New decision support tools
- **Support for live demonstrations**

Project FY 10 Funding Profile

Surface Tactical Flow

	<u>Prior</u>	<u>FY06</u>	<u>FY07</u>	<u>FY08</u>	<u>FY09</u>	<u>FY10</u>	<u>FY11</u>	<u>FY12</u>	<u>FY13</u>	<u>FY14</u>	<u>Beyond</u>	<u>Total</u>
F&E CIP	0.0	0.0	0.0	5.0	5.0	10.0	10.0	5.0	5.0	5.0	15.0	60.0
F&E Requirements	0	0	0	5	5	10	12.7	13.8	14.3	15.2	50.1	131.1
Delta	0	0	0	-5	0	0	-2.7	-8.8	-9.3	-10.2	-35.1	-71.1

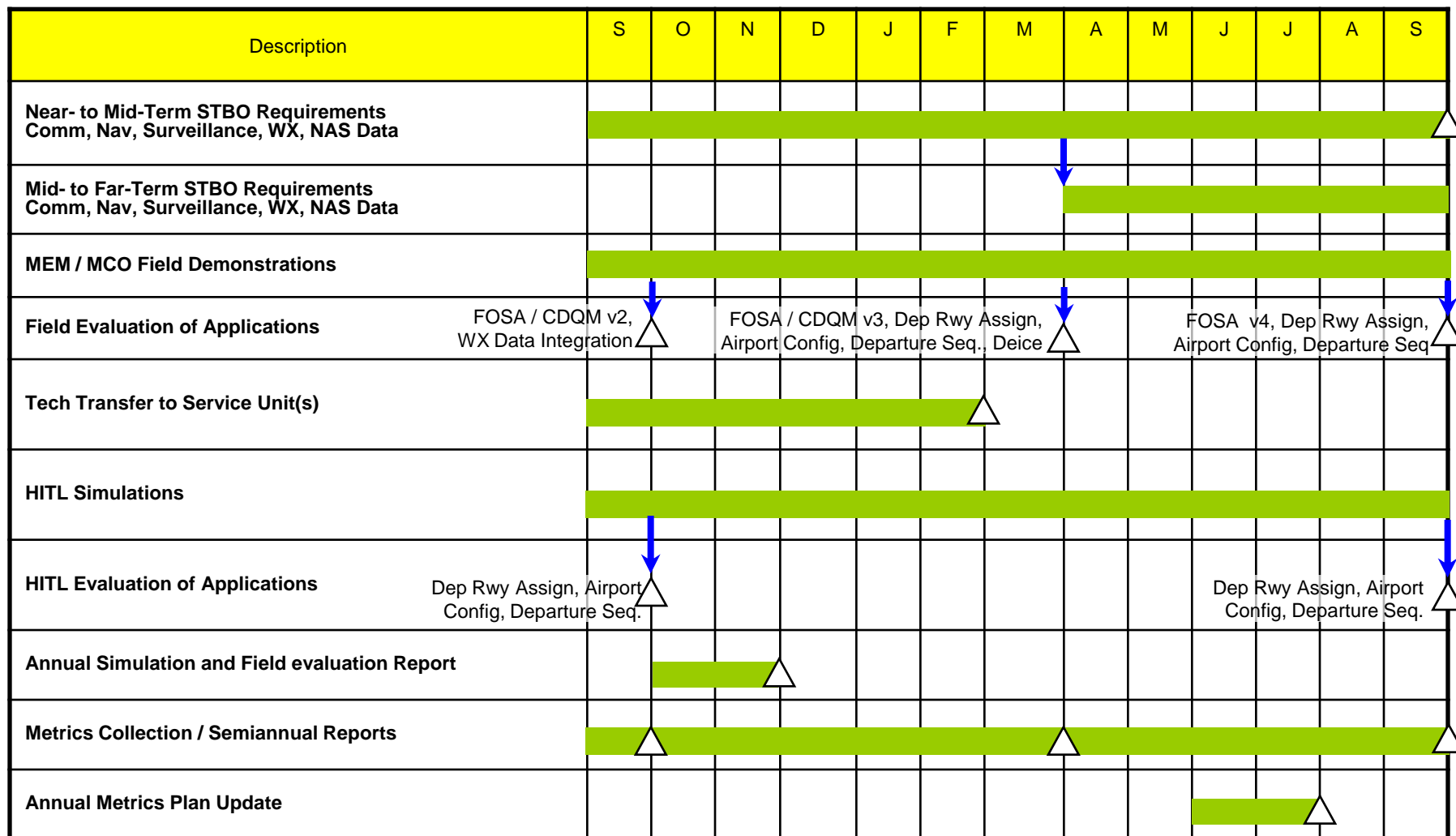
Surface Conformance

	<u>Prior</u>	<u>FY06</u>	<u>FY07</u>	<u>FY08</u>	<u>FY09</u>	<u>FY10</u>	<u>FY11</u>	<u>FY12</u>	<u>FY13</u>	<u>FY14</u>	<u>Beyond</u>	<u>Total</u>
F&E CIP	0.0	0.0	0.0	0.0	3.2	3.2	4.0	4.0	4.0	4.0	6.0	28.4
F&E Requirements	0	0	0	0	3.2	3.2	5.0	5.8	6.3	7.2	18.0	48.7
Delta	0	0	0	0	0	0	-1.0	-1.8	-2.3	-3.2	-12.0	-20.3

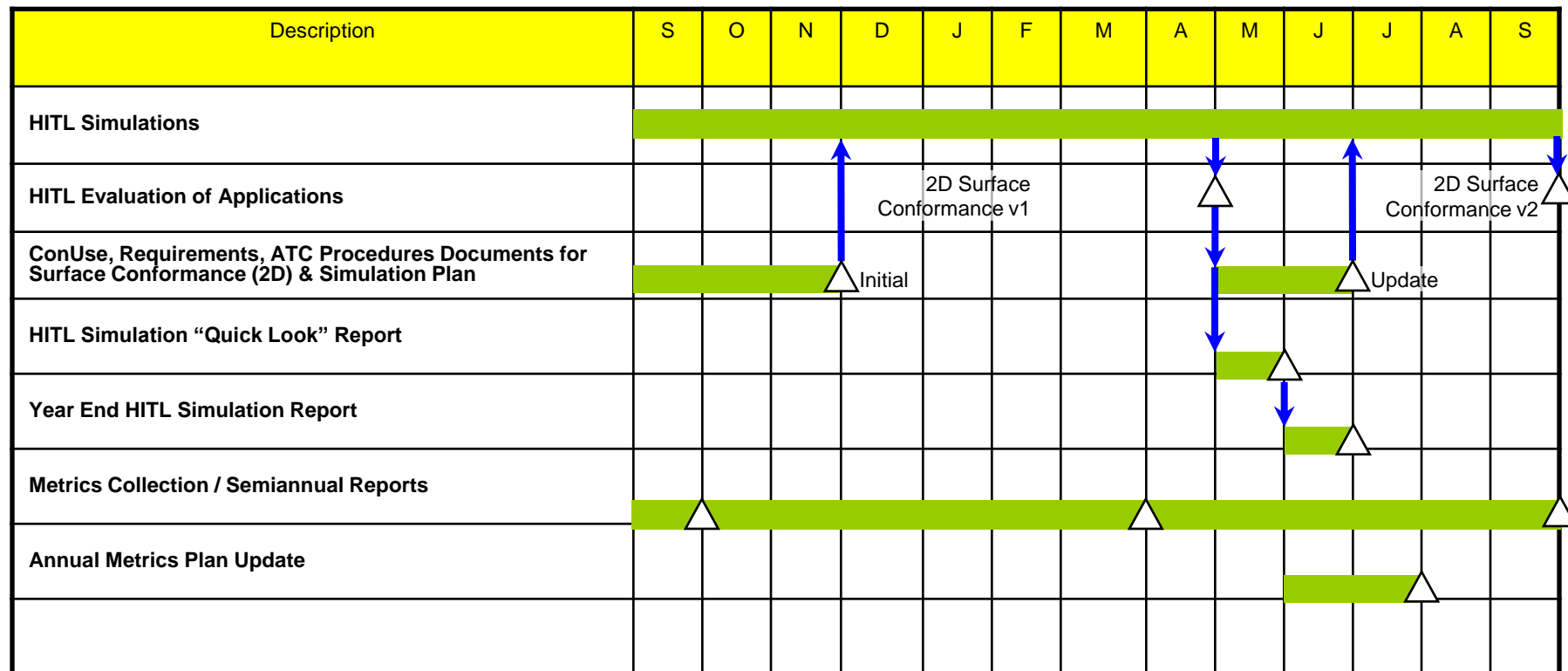
Surface Tactical Flow Project Schedule **FY 10**

Description	S	O	N	D	J	F	M	A	M	J	J	A	S
Near- to Mid-Term STBO Requirements Comm, Nav, Surveillance, WX, NAS Data													
MEM / MCO Field Demonstrations													
Field Evaluation of Applications	FOSA / CDQM v0.5 (FedEx / MEM only)						FOSA / CDQM v1				FOSA / CDQM v2, WX Data Integration		
HITL Simulations													
HITL Evaluation of Applications													
Metrics Collection / Semiannual Reports													
Annual Metrics Plan Update													

Surface Tactical Flow Project Schedule **FY 11**



Surface Conformance Project Schedule **FY 10**



Surface Conformance Project Schedule **FY 11**

Description	S	O	N	D	J	F	M	A	M	J	J	A	S
Near- to Mid-Term STBO Requirements Comm, Nav, Surveillance, WX, NAS Data													△
Mid- to Far-Term STBO Requirements Comm, Nav, Surveillance, WX, NAS Data													
MEM / MCO Field Demonstrations													
Field Evaluation of Applications													
Annual Tech Transfer to Service Unit(s)													
HITL Simulations													
HITL Evaluation of Applications													
Annual Simulation and Field evaluation Report													
Metrics Collection / Semiannual Reports													
Annual Metrics Plan Update													

Project Status

- **Memphis test bed operational 24/7 since July 2008**
 - Conducted live Collaborative Departure Queue Management (CDQM) algorithm tests with FedEx in September 2009
 - Additional evaluations with FedEx scheduled for mid November 2009
 - Flight Operator Surface Interface (FOSA)
 - CDQM
 - CDQM “mixed operations” eval planned for March 2010
 - FedEx
 - Delta / NWA
 - Minor operators (smaller airlines, GA, ANG)
 - ATC
- **Installation work at Orlando recently completed**
 - Prototype operational in September 2009
 - Initial operator system training completed
 - System familiarization, optimization and operational analysis in progress
 - Initial field eval of CDQM in March 2010
- **Supporting STBO acquisition via Tower Flight Data Manager (TFDM)**
 - Initial implementation path for STBO capability
- **Surface conformance work in progress**
 - Initial ConOps completed
 - Initial Requirements and ATC procedures delivered
 - Simulation planning
 - Human-in-the-loop simulation in April 2010



STBO Key Project Personnel

Title	Name	Org	Phone
Project Lead	Tom Prevost	AJP-67	7-3363
Asst Project Lead /Field Support	Steve Beamer	AJP-652	609-485-5823
Program Support	Bill Boggs	STI	703-505-7797
Program Support	Susan Passmore	STI	703-328-2051
System Engineering	Gene Wong	STI	7-9410
AMS Coordinator	Dave Judge	Veracity	301-412-5687
ConOps / Simulation	Katie Klein	MITRE	703-983-1435
Demo Site Support	Steve Creaghan	Volpe	617-494-2924
STBO SME	Chris Brinton	Mosaic ATM	703-737-7637
IT Security	Ed Gillespie	STI	7-8404
	Jack Thomas	Endeavor	703-862-7392
Metrics / Cost-Benefit	Dan Howell	MCR	937-427-9381
NextGen HD SSC	Rob Hunt	FAA	202-384-7077

Backup Slides



Acronyms and Abbreviations

ADS-B	Automatic Dependent Surveillance-Broadcast
AMS	Acquisition Management System
AOC	Airline Operation Center
ARTCC	Air Route Traffic Control Center
ASDE-X	Airport Surface Detection Equipment - Model “X”
ATC	Air Traffic Control
ATCSCC	Air Traffic Control System Command Center
ATCT	ATC Tower
ATDP	Advanced Technology Development and Prototyping Group
ATO-P	Air Traffic Operations - Operations Planning
ATSP	Air Traffic Service Provider
CAASD	Center for Advanced Aviation System Development
CARTS	Common Automated Radar Tracking System
CDQM	Collaborative Departure Queue Management
CDR	Coded Departure Route
CDS	Collaborative Departure Scheduling
ConOps	Concept of Operations
CRD	Concept Requirements Definition
DataComm	Data Communications Program
DST	Decision Support Tool
ERAM	En Route Automation Modernization
FA	Functional Architecture
FOSA	Flight Operator Surface Application
FSM	Flight Schedule Monitor
ICD	Interface Control Document



Acronyms and Abbreviations

ITWS	Integrated Terminal Weather System
JPDO	Joint Planning and Development Office
OI	Operational Improvement
MCO	Orlando International Airport
MEM	Memphis International Airport
NAS	National Airspace System
NCP	NAS Change Proposal
NextGen	Next Generation Air Transportation System
RNP	Required Navigation Performance
RTT	Research Technology Team
SDSS	Surface Decision Support System
SMA	Surface Movement Advisor
SMS	Surface Management System
STARS	Standard Terminal Automation Replacement System
STBO	Surface Trajectory-Based Operations
STM	Surface Traffic Management
SWIM	System Wide Information Management
TBO	Trajectory-Based Operations
TDWR	Terminal Doppler Weather Radar
TFM	Traffic Flow Management
TFMS	Traffic Flow Management System
TMA	Traffic Management Advisor
TMC	Traffic Management Coordinator
TMU	Traffic Management Unit
TRACON	Terminal Radar Approach Control
TSA	Transportation Security Administration



November 2009 CDQM Eval Schedule

- **Week of Nov 9**

- Nov 9 – install in MEM on test string of updated SDSS/CDQM. technical check-out of CDQM browser-based display and associated networking.
- Nov 9 overnight - shadowing with CDQM browser-based display.
- Nov 10 overnight – more shadowing and check-out
- Nov 11 & 12 overnight – operational testing of CDQM

- **Week of Nov 6**

- Nov 16-19 overnights – four additional periods of operational testing and data collection of CDQM performance

PLA Milestone Status (Surface Tactical Flow)

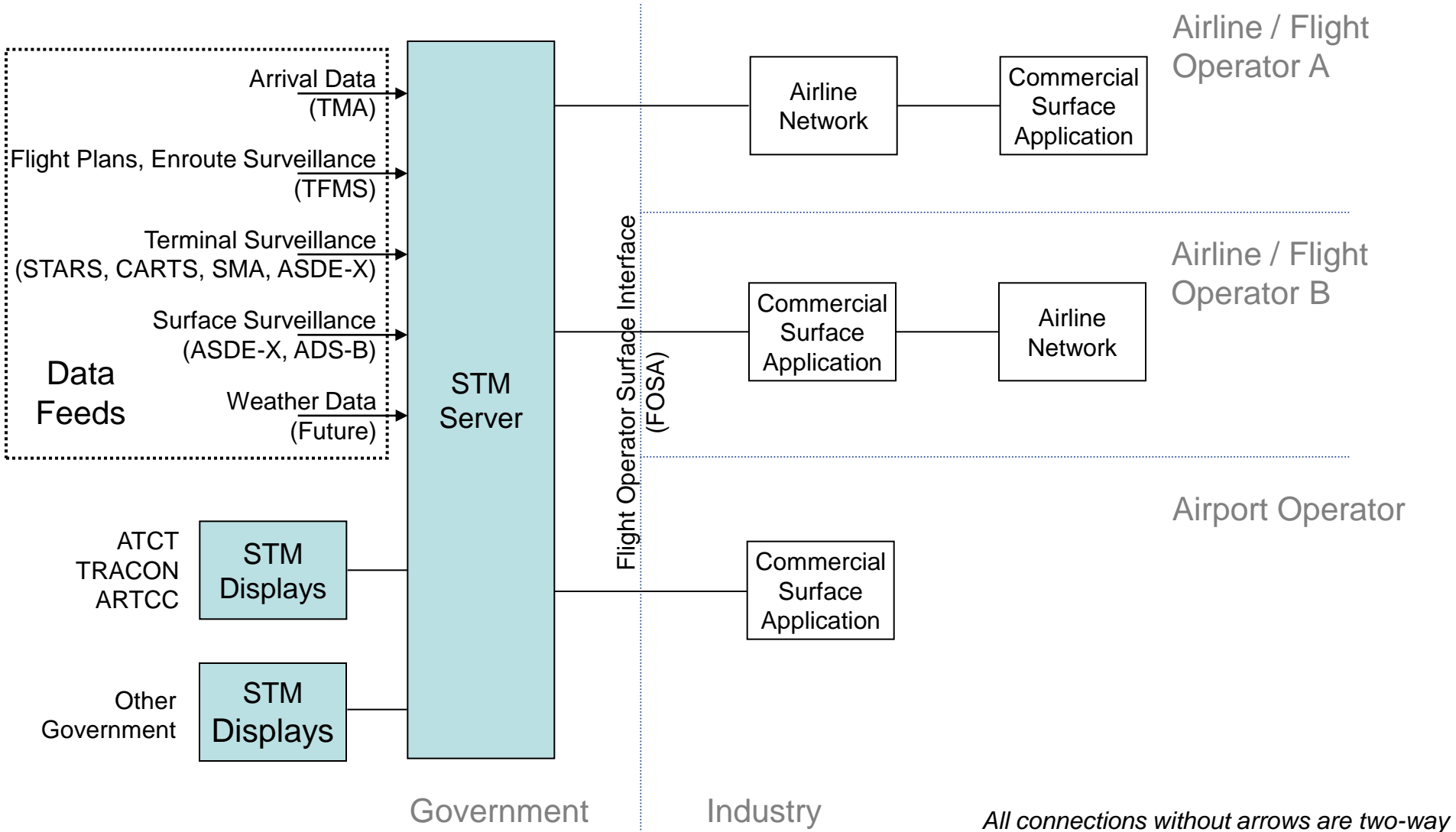
DRAFT Fiscal Year 2010 Milestones	Date	Status
Detailed, activity-based, project schedule loaded into the NextGen PMT	T+1	
Field evaluation of Collaborative Departure Queue Management concept at Orlando	03/31/2010	
Annual Metrics Plan Update	07/31/2010	
Conduct initial HITL simulation of 2D Taxi Route Generation Tool, Departure Runway Assignment Decision Support Tool, Airport Configuration Decision Support Tool, and Departure Sequencing Decision Support Tool	09/30/2010	
Field Evaluation of Flight Operator Surface Application (FOSA) Version 2 Interface concept and Collaborative Departure Queue Management Version 2 concept and Weather Data Integration at Memphis and Orlando	09/30/2010	
Complete fast-time simulation / validation of CDQM algorithm on multiple airports	09/30/2010	
Adapt Volpe deice modelling tool for FY11 evaluation at Memphis	09/30/2010	
Complete drafts at the 50% maturity level of STBO near-to mid-term requirements documents and gap analyses for data communications, navigation, surveillance, weather, and NAS data	09/30/2010	
Semi-Annual Metrics Report	09/30/2010	
Simulation and field evaluation "Quick Look" report	11/30/2010	
Annual simulation and Field evaluation Report	12/31/2010	

PLA Milestone Status (Surface Conformance)

DRAFT Fiscal Year 2010 Milestones	Date	Status
Detailed, activity-based, project schedule loaded into the NextGen PMT	T+1	
Evaluation Plan, Updated ConUse, Requirements and Procedures documents for September 2010 HITL simulations	08/31/2010	
Conduct Second Surface Conformance (2D) HITL Simulations	09/30/2010	
HITL Simulation "Quick Look" Report	11/30/2010	
Year End HITL Simulation Report	12/31/2010	



Test Bed Notional Architecture

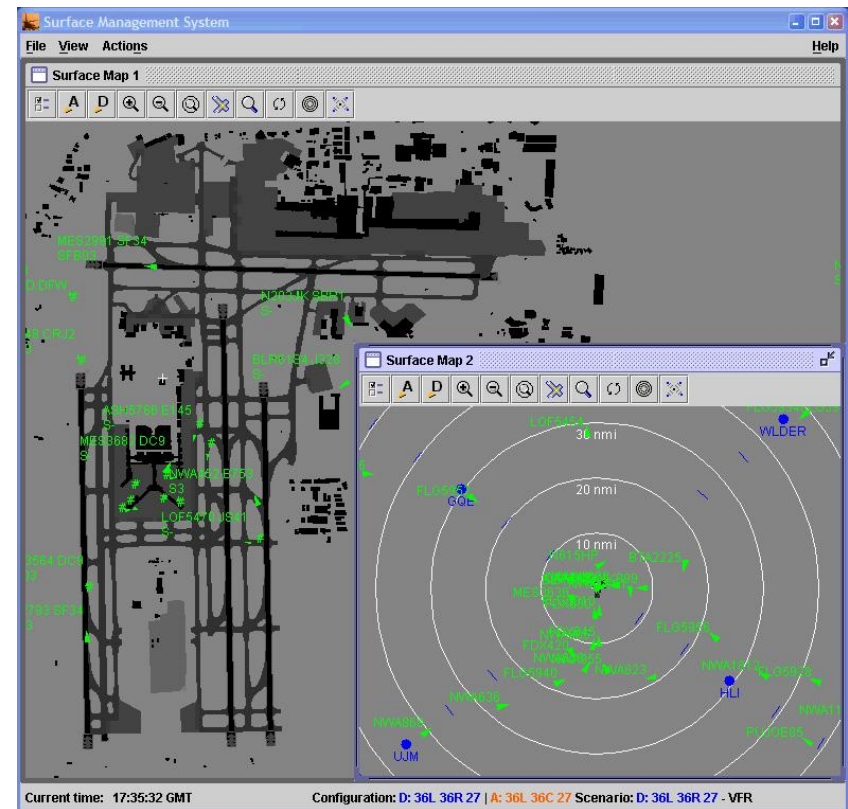


The screenshot displays the SDSS Map 2 - FAA interface, which is a complex tool for air traffic simulation and management. The interface is divided into several key sections:

- Toolbars:** Located at the top, these include menus for File, View, Action, and Help, as well as various icons for map manipulation and data viewing.
- Map:** The central area shows a detailed map of the airspace, with various flight paths and aircraft positions visible. A red arrow points to the map area.
- Timeline:** A vertical timeline on the right side of the map displays the sequence of events, including arrivals and departures, with specific aircraft and times listed. A red arrow points to the timeline.
- Table:** A large table at the bottom left provides a detailed view of the flight data, including columns for Flight ID, AFD, Origin, Dest, Tail, AC Type, Rwy, Cdg Fr, Air Fr, Status, Out Time, Off Time, On Time, and In Time. A red arrow points to the table.
- Load Graph:** A graph at the bottom right shows the number of aircraft over time, with a red arrow pointing to the graph.

Sample Capability: Airport Situational Awareness

- **Dynamic Graphical Display of:**
 - Aircraft Positions
 - Departure Queues
 - Arrival Demand
 - Holding Flights (Surface and Airborne)
 - Closed Taxiways
 - Scheduled Flights
- **Used by ATC:**
 - Planning Runway Configurations
 - Runway Assignments
 - Sequencing
 - Gate/Ramp Congestion Management
 - Taxiway Management
- **Used by Flight Operators:**
 - Inbound Arrival Time Prediction
 - Outbound Staging of Flights



Sample Capability: Local Sharing of Surface Data

- **Flight Operator -> ATC**

- Parking Gate Assignment/Spot
- Scheduled Push-back Time
- Pre-push-back Status
- Acceptable CDRs
- Local Slot Substitutions
- Gate/Ramp Conflict Resolution

- **ATC -> Flight Operator**

- Assigned Off Times
- Predicted On and In Times
- Runway Assignments
- Traffic Management Initiatives
- Gate/Ramp Conflict Alert

